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PRESSURE GASHOLDERS

THE storage of gas under pressure is comparatively a new technique in the Gas Industry. In our columns last week Mr. Frank H. Robinson claimed to be the first to erect two small high-pressure holders for the Harrogate Gas Company at Boroughbridge in the spring of 1930, which installation is still giving satisfaction. Then, in 1933, came the pressure holder erected at Skipton; and information given at the recent Institution meeting shows that it has fully justified hopes and intentions. It is well to remind ourselves that the use of vessels operating under considerable internal pressure is quite a normal feature of chemical engineering to-day. There are many reactions that proceed better under pressure than under atmosphere conditions. These reactions are therefore conducted now as a matter of routine at pressures far higher than anything yet visualized as normal practice by the Gas Industry. Of course, use of gas cylinders capable of withstanding a pressure of 3,000 lb. per sq.in. for storing gas on vehicles has been established, and so also is the use of vessels under a pressure of 5,000 lb. per sq.in. for the storage of the gas that is to be supplied to the cylinders. Employment of pressures of the order of 3,000 to 4,000 lb. per sq.in. at temperatures as high as 450° C. is standard practice for the hydrogenation of coal. These vessels, moreover, are of considerable size, greater, we believe, than anything yet used for the storage of gas under pressure. The petroleum industry, too, employs pressure vessels for the refining and cracking of petroleum oils. Fractionation columns operating under pressure and at elevated temperature may be of considerable size.

The conclusion is clear. There is nothing fundamentally new in the employment of pressure vessels, while the pressures used in the Gas Industry are small by comparison with those of other industries. Moreover, since gas storage vessels operate at atmospheric temperature, their design is not a matter of very great difficulty. For the same reason, their cost should not be in any way comparable to that of the vessels used at higher pressures and temperatures in the chemical industry. The use of high pressure generally has extended so greatly within recent years that there is no unknown factor in designing and constructing a vessel to work at any reasonable pressure and temperature—the facts that steam boiler pressures have risen to 1,400 lb. per sq.in. and over and superheat temperatures to 1,000° are additional evidence of this—provided that the purchaser is prepared to pay the cost. As the pressure and the general severity of the conditions go up, so the precautions necessary in manufacture increase, the use of thicker metal becomes imperative, tests increase in complexity, and the cost inevitably mounts. The problem of gas storage facing the Gas Industry in the future may well involve consideration of what should be the pressure having regard to the capital cost, and to the operating cost.

The Paper contributed by Mr. G. M. Gill to the Institution meeting gave a lucid account of pressure holder practice. It seems clear that the pressure holder has a well-defined function in the scheme of gas storage. That function is to provide a supply of gas at an outlying district when existing mains are too small to maintain the pressure during peak periods. When the existing main becomes insufficient in capacity over temporary periods it is necessary to have or to install a high pressure holder from which gas can be drawn by a compressor during periods when the main is above capacity, and from which the gas can be discharged again into the low pressure distributing mains during the peak periods. There are clearly certain precautions to be observed in the times and conditions under which the compressor is allowed to work, but generally it is found that the system operates to most advantage when the extra gas is needed during certain hours in the daytime, and when the holders are of such capacity that they can supply this gas when it is needed and can be themselves replenished during the night. Increasing prices have caused the situation to arise in which it is rarely economic to build a new low-pressure storage holder of small capacity. The capital cost of storage per 1,000 cu.ft. decreases with increasing size of the holder, and we believe it to be high to-day for small holders. On economic grounds, and on grounds of labour saving, the high pressure holder has much to recommend it when conditions are suitable for its use.

AMENITIES

There is, however, another point. We must face the fact that the gasholder is normally an unsightly edifice. We must also face the fact that it is becoming increasingly recognized as such by local Councils and others in charge of town planning. Several speakers at the Institution meeting referred to objections raised by Councils against the installation of gasholders in certain districts. A gas-works, properly designed and properly maintained need not be unsightly. It can be as pleasing architecturally as any other large building or works. Some recent retort houses and other works buildings have in their architectural features been more akin to a modern cathedral than to the gasworks of tradition. But the gasholder has not kept pace. The Victorians ornamented their holders according to their fashion, and no doubt pleased their contemporaries. We Georgians do not like ornate design; our tastes run along more severe lines. It may be possible to do something with camouflage; but is it not time that we designed gasholders so that they might be architecturally pleasing? A suggestion might be for the Institution to offer a prize to architects for the best gasholder design. Failing that, the only thing to do is to hide it. A tall screen of quick-growing trees might do much. When a site is scheduled for the erection of holders, would it not be a good move immediately to plant sufficient trees around the site to hide

whatever is put thereon at some later date? A modern gasworks can be ornamented with lawns and trees; so also can a gasholder site. We need to move from the age of severe utility, which was founded on the saying: "Where there's muck there's money,"—a saying that has caused untold misery to the human race—to an age which regards the place in which one spends most of one's working and waking hours, as at least as important aesthetically as that in which the few days of holiday are passed annually.

But we digress from our theme. One way of hiding a gasholder effectively is to put it—and keep it—under the sky line. While spiral holders are a part answer to this, the real answer appears to be the horizontal pressure holder. It is possible, therefore, that the Gas Industry may have to develop this technique for residential and country districts. It would then be necessary to make the low pressure gas main sufficiently large to take the maximum *average* daily consumption with a reasonable margin for contingencies, and to make the high pressure holders sufficiently large to provide for the peak and to be replenished with gas during the valleys of consumption.

TOTAL DISTRIBUTION COSTS

An objection has been raised to high pressure holders on the ground that the cost of compression represents a constant charge which is fairly considerable. There is no doubt that, as anyone who has the curiosity to calculate the cost of gas compression will readily discover, compression costs are a considerable proportion of the total distribution costs of high pressure gas. Considerable as are the advantages of high pressure gas, cheap distribution is secured by low pressure mains for which the holder pressure provides sufficient motive power to overcome friction. The cost of compression, however, can be easily over-estimated, because under the system to which reference is here made only a proportion of the gas need be compressed. The larger the capacity of the low pressure mains relative to the total gas requirement of the district, the lower may be the cost. This statement, however, must not be allowed to pass unqualified because there must evidently be a minimum in the cost curve. There will probably be a minimum at which the operating costs of the compressor plus the capital charges on the main holder and compressor will be more favourable than the cost of installing larger gas mains, even in a new installation. We have not worked this out in detail but we have little doubt that the point will be appreciated by distribution engineers who may be relied upon to enlighten us as to whether this minimum cost does in fact exist and under what conditions it obtains. We do not think that the last word has been said yet upon the use of high pressure holders at the end of a gas main serving an outlying district. The amount of gas to be compressed may be quite small in relation to the total gas, as has already been indicated. Mr. McNair stated, in the course of the discussion on Mr. Gill's Paper at the Institution meeting, that at Skipton the maximum day's demand is 600,000 cu.ft. and of that, 250,000 cu.ft. is stored under high pressure conditions. The maximum use made of this high pressure gas, however, is only about 100,000 cu.ft. per week at the change of the season while at other times as much as two months may pass without the pressure holder being brought into use at all.

The design and construction of a pressure holder is a subject upon which there may be more than one opinion. There is no final and agreed pressure at which these holders would operate. For various reasons a pressure of about 60-70 lb. per sq.in. appears to have been established as a general operating pressure. In our issue of July 10 details were given of a large holder built for a maximum working pressure of 73 lb. per sq.in. Mr. Birks suggested at the Institution meeting that it would be desirable to go to higher pressures of the order of 16 atmospheres, or say 240 lb. per sq.in. He pointed out that by working at this pressure the power consumption would only be doubled while there would be conveniences in the size of the vessel and in the manufacture of the vessel in one piece at the works. The foundations would be cheapened, the hydraulic test would be simplified, and the quantity of locked-up gas would be reduced to 25% of what it is at present. There would be no difficulty, as we have already indicated, in designing vessels for these higher pressures, but it is almost inevitable that as the pressures increase so also will the capital cost. Another debatable matter is whether pressure holders should be riveted or welded. This controversy cuts deep into all sections of industry. Boilers are generally riveted and it appears that the insurance companies greatly favour this method of construction. The drums of high pressure boilers, however, are welded and so also is a great deal of the pressure plant used in the chemical industry. At the comparatively low pressures used in the Gas Industry there would seem to be no particular difficulty in using welded vessels of the ordinary Lloyds class B specification. When we come to the higher pressures, however, and involve Lloyds Class A, with X-ray examination of the weld, we shall probably find ourselves in a more expensive field. We do not propose to pursue this particular controversy further—there has already been correspondence on the subject in recent issues of the "JOURNAL"—because by so doing we stand a very good chance of being ground between the mill-stones of those who advocate welding and those who advocate riveting. These stones grind slowly, but we have little doubt that if we found ourselves between them we should be ground exceedingly small.

Staff Bonus and Salary

In our contributed report of the Annual Delegate Meeting of the Gas Staff Association ("JOURNAL," June 12, p. 971), one of the speakers was reported to have said that "among the many matters negotiated were an excellent war bonus and consolidation with salary and the counting of all war bonus towards pensions." We have received from Mr. L. G. Wright, London District Official of the National Union of General and Municipal Workers, a letter stating that in point of fact it was the N.U.G.M.W. who carried out the entire negotiations in connexion with the issue in question.

Diary

July 25.—B.G.C. Eastern District Meeting, 2.15 p.m., Gas Industry House.
July 26.—B.G.C. London District Meeting, 2.30 p.m., Gas Industry House.
July 30.—B.G.C. Scottish District Meeting, 2.15 p.m., City Chambers, Edinburgh.
July 30.—Domestic Development Committee, 2.30 p.m., Gas Industry House.
July 31.—Domestic Development Committee: Technical Sub-Committee, 10 a.m., Gas Industry House.
Sept. 10.—B.G.C.: Meeting at Gas Industry House, 2.30 p.m.

On July 2 the Staff of the Coventry Corporation Gas Department held their summer outing to Oxford. Over 60 members and friends set off by coach at 10.30 a.m., reaching Oxford by 12.30 p.m. to have lunch prepared by the Municipal Restaurant. Here they were joined by Mr. P. N. Langford, their former Engineer and Manager, who retired on Sept. 30 last. Mr. J. E. Wakeford, the new Chief, expressed the pleasure of the staff in being able to renew acquaintance with Mr. and Mrs. Langford. A steamer trip to Abingdon had been arranged for the afternoon to enable the party to have tea at Salters Tea Gardens. On the return journey the members left the boat at Sandford Lock and were conveyed by bus to the Oxford Playhouse, where seats had been booked for J. B. Priestley's play "Laburnum Grove," given by the Oxford Repertory Company.

Personal

Staff Appointments at Birmingham

The retirement of Mr. J. H. Darrah in September next, coupled with the election of Mr. G. C. Pearson to the Presidency of the Institution of Gas Engineers, has necessitated a re-arrangement of the Engineering Staff of the Birmingham Gas Department. Institution matters will take much of Mr. Pearson's time, and it is with this in mind the following appointments have been made:

Mr. S. K. HAWTHORN to be Deputy Chief Engineer, with office at Saltley Works. Mr. Hawthorn entered the service of the Department in 1918 and received a thorough training in laboratory and drawing office practice, becoming Junior Engineer at Nechells Works in 1927. Later, he transferred to Windsor Street as Retort House Superintendent, and in 1931 was appointed Technical Assistant to the Engineer-in-Chief under Mr. Tomlinson. In 1936, when the latter retired, Mr. Hawthorn was appointed Engineer at Windsor Street.

Mr. F. H. BATE will assume the post of Engineer at Windsor Street. Mr. Bate also has spent all his career at Birmingham under Dr. E. W. Smith and Mr. T. F. E. Rhead, chiefly in research work with special reference to coal and carbonizing technology. In 1932, he transferred to the Engineering Staff in charge of the Retort House at Windsor Street. In 1936, Mr. Bate followed Mr. Hawthorn as Technical Assistant to the Engineer-in-Chief and remained in that capacity throughout the war. He is a member of the local Gas Engineering Advisory Board, an organization designed to assist Gas Undertakings in their wartime difficulties, and which is still functioning in the interests of fuel economy. He is a graduate of London University and a member of the Board of Examiners of the Institution of Gas Engineers.

Mr. R. G. WARR will succeed Mr. Darrah as Engineer at Nechells. Mr. Warr commenced at the Central Laboratory in 1912 and has served at all the Works in various capacities—as Junior Engineer, General Foreman, Assistant Engineer and Engineer, and for the last three years as Engineer at Swan Village. This accumulated experience will prove invaluable when Mr. Warr takes over at Nechells, where a large programme of new work is shortly to be undertaken, including additional carbonizing plant for 4,000,000 cu.ft. per day, renewal of the whole of the coal gas purifying plant and a big extension to railway sidings. Mr. Warr was a Captain in the Home Guard and organized the Gas Department Battalion from the days of the L.D.V. An indication of the magnitude of this task may be gained from the fact that the first nominal roll exceeded 700 men distributed over the various works, and the final efficiency of the Unit owes much to this foresight.

Mr. W. H. WHITING will become Engineer at Swan Village in succession to Mr. Warr. The whole of Mr. Whiting's career has been on the Engineering Staff, commencing in 1908 in the Drawing Office at Nechells, afterwards serving in the Fittings Shops and Central Laboratory, proceeding to Windsor Street in 1914 as Junior Engineer. Later he served at Saltley, as General Foreman at Windsor Street, and Assistant Engineer at Saltley and Nechells.

The post of Assistant Distributing Engineer has been filled since April 1 by Mr. F. L. ATKIN. Mr. Atkin, who joined the Department in 1917 as a draughtsman in the Industrial Research Laboratories and has devoted much time to the development of gas furnaces and infra-red tunnels, was formerly the Assistant Superintendent of the Industrial Heating Section. From the same date, Mr. E. T. PICKERING was appointed Deputy Chief Chemist at the Central Laboratory, where he joined the Chemical Staff in 1915. After war service he studied at Birmingham University and returned to the Central Laboratory in 1922. Noted as a lecturer in gas engineering subjects, he was President of the Midland Junior Gas Association in 1937-8 and is Hon. Secretary of the Midland District Education Committee. He has recently been elected a Fellow of the Royal Institute of Chemistry.

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During the proceedings at the recent meeting of the Manchester District Association of Gas Engineers at Bradford Mr. G. Currier, the President, presented Mr. CHARLES WOOD, O.B.E., with an Illuminated Address to mark his Diamond Jubilee as a member of the Association. Though Mr. Wood had retired from professional life in 1927, he had continued to attend the meetings of the Association. He was a "live" member of the organization, and had rendered much valuable service to it. Mr. Wood, in acknowledging the presentation, said he had attended nearly every meeting which had been held during the past 60 years.

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Acting on medical advice, Mr. C. S. ROSE has retired from the post of Advertising Manager to Radiation, Ltd. Mr. Rose was formerly Advertising Manager of Messrs. John Wright & Co., Ltd., of Birmingham, being appointed to his position with Radiation, Ltd., when the firm was created almost 25 years ago. He is succeeded in the position by Mr. ERNEST GALLEY, who for some time was Editor of the Dutch News Service of the European Division of the B.B.C. before joining John Wright & Co. in January of this year.

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After 44 years with the Glastonbury and District Gas Company, Mr. D. E. GARLICK, its Engineer and Manager, has retired. Commencing at the Kilnwick Parish Gas Company in 1886 and later moving to Barnoldswick, Mr. Garlick was appointed Manager and Secretary of the gas department of the Glastonbury Corporation in 1902. This position he held for 42 years, relinquishing the post of Secretary in 1944 but continuing as Engineer and Manager. During his long service the sales of gas have increased from 20 to 90 mill. cu.ft.

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Mr. G. GILDEN has been appointed Manager of the Liverpool Gas Company's Wavertree Works. He joined the Company as Assistant Works Manager at Garston in 1944. Before going to Liverpool Mr. Gilden was with the Altrincham Gas Company, followed by a period as Assistant Engineer to the Hampton Court Gas Company.

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Mr. G. E. C. PEDLER, Superintendent of the Turbine Section of the Construction Department of the British Thomson-Houston Co., Ltd., has retired after nearly 44 years' service with the Company. Mr. Pedler obtained his early engineering training with Messrs. Geo. Waller & Co., and joined the B.T-H. Company in 1903. On the death of Mr. T. J. Reynolds in 1925, he was appointed Superintendent of the Turbine Section of the Construction Department. At a gathering at Rugby of the various District Engineers and their Assistants, and members of the Turbine Departments, Mr. J. S. Ramsden, Senior Commercial Director, presented a silver salver to Mr. Pedler on behalf of his colleagues and friends. Mr. J. ASHTON has been appointed Acting Superintendent of the Turbine Section of the Construction Department. Mr. Ashton was, for the 21 years of Mr. Pedler's administration, his Chief Assistant. Mr. Pedler will continue to be connected with the B.T-H. Company in a consulting capacity.

Obituary

The death occurred on July 13 of Mr. JOHN DUNCAN, Kirriemuir, who, for 40 years, was Manager of the Kirriemuir Gas Company. He retired in 1940 and was 83 years of age.

Operation of Gas Producers

The Ministry of Fuel and Power has added to the series of fuel efficiency bulletins a manual on the operation of gas producers, designed to appeal not only to the operative but also the producer superintendent.

The main text, while dealing briefly with the general principles of gasification and the characteristics of fuels, is primarily intended to give guidance in operation to those actually doing the job. Appendices are included in which the blast saturation temperature, fuel characteristics, instruments, automatic control, and the combustion of producer gas are discussed from a somewhat more technical angle for the benefit of the producer superintendent.

One of the points stressed in the bulletin is the importance of employing a producer superintendent and of ensuring adequate liaison between those responsible for the operation of the plant and those using the gas produced by it. The bulletin should also have considerable value in helping the producer superintendent to instruct the operative in the main principles of his task.

Copies of this publication are obtainable free on application to the Regional Offices of the Ministry of Fuel and Power.

Cheltenham Builds Permanent Homes

In the nature of an experiment, and with the intention of offering first priority to bombed-out families, the Cheltenham Town Council invited, through their Housing Committee, plans for the erection of six permanent council houses on the site of six which had been demolished by enemy action.

A questionnaire was sent to every women's organization in the town, as well as to individual women who are known to be deeply interested in the matter of housing. By this means the views of a cross-section of the community were obtained. The replies when summarized provided valuable data which formed a starting point in the planning of the post-war homes in the town. Several features in the design finally adopted were the result of the answers.

Early this year the block of houses was finished. To explore the possibilities of using semi-skilled labour, two of the houses were built of unorthodox material—foamed slag concrete. Brought from Lincolnshire and cast into blocks in Gloucestershire, it is claimed that this concrete has properties which result in coolness in summer and warmth in the cold months. In appearance it is pleasing to the eye, and the large blocks, measuring 18 in. by 9 in. when used "undressed," have the effect of giving width and height to the workshop and shed.

The bombed-out families were given the option of first refusal by the Council, but all were so anxious to return to homes of up-to-date design that they accepted the offer, and now have permanent homes with all the improvements of modern construction—heating, hot water supplies, kitchen equipment, and labour-saving domestic appliances. All the arrangements for supplying and fitting gas equipment in three of the houses were made by the Cheltenham and District Gas Company, and most of the appliances were supplied by Radiation, Ltd. Gas now plays an important part and makes a valuable contribution towards the comfortable living conditions in each.

Manchester Gas Sales Increase

Gas sales at Manchester for the year ended Mar. 31 totalled 8,094,964,000 cu.ft., an increase of 21.553,000 cu.ft., or 0.27% compared with the previous year. The annual report of the Gas Committee states that the increase is attributable to the continued heavy demand being made by domestic consumers. The average price realized was 3s. 6.47d. per 1,000 cu.ft. (9.44d. per therm), as compared with 3s. 5.06d. (9.12d. per therm) for the previous year. The increased price yield is wholly due to the greater quantity of gas sold to domestic consumers. The quantity of gas consumed for industrial and commercial purposes during the year, mainly under special contracts and two-part tariff rates, was 3,298,445,000 cu.ft., or 40.75% of the total sales. Special contracts, including bulk supplies, are now in operation with 234 consumers.

Income from coke shows an increase of £51,314 compared with the previous year, which arises out of a further increase of 3s. 6d. per ton authorized by the Ministry of Fuel and Power as from May 1, 1945, and also the effect of the rise in price from Aug. 1, 1944, operating for the whole of the year under review. Throughout the last twelve months the heavy demand has been maintained and, in consequence, no stocks have accumulated. Owing to a higher price being received for tar, the income therefrom has increased by £20,604 as against the amount for last year. Increased revenue from the sale of benzole, &c., is also due to better prices having been obtained during the year.

Expenditure on coal and oil increased by £130,506, as compared with the previous year. Coal supplies have again caused considerable concern, deliveries being substantially less than the winter and summer programmes provided for. Fortunately, no serious interference was caused by exceptionally severe weather. The cessation of Durham coal deliveries and their substitution by materials from normal sources reduced carbonizing difficulties and improved the position in regard to quality. The stocks at the end of the year were equivalent to approximately one winter week's supply, which was even less than the stocks held at the same period in the previous year.

The amount expended on renewals account during the year was £178,313. The heavy expenditure was due to the higher price levels experienced at the present time, and to the fact that since the cessation of active war conditions, it has been possible to carry out a greater measure of renewal and reconstruction work. During the forthcoming year it is proposed to make application to the appropriate Ministry for additional borrowing powers to meet the cost of extension and reconstruction work to be carried out during the next five years.

After appropriating £7,262 in respect of capital expenditure, the balance remaining to the credit of the appropriation account has been carried forward. Accordingly, the reserves of the Department stand as follows:—

	£
Appropriation of net profit account	2,244
Reserve fund account	18,796
Working capital fund account	100 000
Renewals account	182,695
	£303,735

Sales Activities

The continued restriction on the supply of gas appliances retarded the development of the selling activities, but there has been a noticeable improvement in the number of washboilers, cookers, and sink heaters delivered from the manufacturers. The Government's "blanket" order regulations will, however, ensure adequate supplies of appliances and meters for the housing programme. The canteen and commercial equipment section had an extremely busy year, the sales approaching a value of £20,000. The industrial section has also been fully extended with increasing enquiries for the use of gas for industrial purposes, notably for central heating and steam raising.

The Committee, in its report, expresses gratitude to those members of the staff who joined H.M. Forces. Altogether 455 employees served in the armed forces, of whom 18 made the supreme sacrifice. The Committee expresses to their families sincere sympathy at the loss they have sustained. The opportunity also presents itself to thank the temporary staff recruited during the war for their services.

During the year 17,400 street lamps were refitted and lighted, and included 1,600 modern 3-lt. suspensions lamps, which have been substituted for the obsolete square lantern type. The City Council has approved the recommendation of the General and Parliamentary Committee that the gas street lighting installations shall be changed over to electricity during the period of the next five years.

The works, plant, and distribution system have been maintained in good working condition.

Fuel and the Future

The Fuel Efficiency Committee of the Ministry of Fuel and Power, under the Chairmanship of Dr. E. S. Grumell, C.B.E., has arranged a conference on "Fuel and the Future," to take place in London on Oct. 8, 9 and 10. During the intervening months a campaign to promote fuel efficiency and economy is being undertaken by the Ministry through various agencies, and the conference is intended to focus attention on development during the next five to seven years, and on the fuel savings that can be made in industry, non-industrial premises and homes, with the aid of the new equipment now becoming more readily available.

The campaign has a two-fold object—to promote a higher standard of efficiency in the employment of all forms of fuel in every possible field and to secure the maximum economy in use in the national interest and in the interest of the consumers, industrial and domestic alike.

Most sessions will take place at the Central Hall, Westminster. The opening session will be addressed by the Minister of Fuel and Power and the Minister of Health. The Conference will divide into eight sections, six concerned each with one group of industries having related fuel problems, a seventh with the problems of architects in connexion with new housing, and the eighth with women's views on domestic heating.

There will be two general discussions on "Sizing and Grading of Coal" and "District Heating," and the Minister of Fuel and Power will take the chair at the closing session.

The Institute of Fuel is co-operating in the Conference, and has accordingly arranged for the Melchett Lecture to be given on the evening of Oct. 8. The annual reception, dinner and dance at the Institute are being arranged for Oct. 9.

"Furnace Practice" Film

A new educational film dealing with furnace practice has been prepared for the Ministry of Fuel and Power, and copies, in both 35 mm. and 16 mm., are available on loan from the Central Film Library and on application to Regional Fuel Officers of the Ministry. It is accompanied by a running commentary.

The film is designed to appeal to executives, operatives and students interested in the operation of furnaces in the ferrous and non-ferrous metal industries, and to promote the efficient use of all kinds of fuel. Correct methods of using coal, pulverized coal, coke, gas, oil and electricity in various types of furnace are illustrated, the film, which is essentially practical, having been taken under ordinary working conditions. Animated diagrams are used to illustrate the operation of recuperators and regenerators in a sequence devoted to the recovery of waste heat, and in a sequence on the importance of furnace insulation, while the film ends with some examples of waste.

The film is in three reels, and occupies 27 minutes. It was made for the Ministry by the C.W.S. Film Unit, with Mr. George Wyn as director and Mr. Sidney N. Duguid as commentator.

Soil Corrosion Researches

There is at present a widespread interest in the extended use of copper pipes buried underground for the conveyance of both water and gas. Although large mileages of copper pipe laid in a variety of soils have for years been giving satisfactory service in different parts of the world, interest in the use of copper for underground service pipes has, until recently, been confined to only a few areas in this country. For example, in Manchester and Dundee many miles of buried copper pipes have given satisfactory service for a number of years past.

The present interest in the use of copper tube underground is in some measure due to the accumulating favourable results of independent research investigations carried out in this country by such bodies as the Manchester Corporation Water Works Department, the British Non-Ferrous Metals Research, and Electrical Research Associations, and, abroad, by the National Bureau of Standards of the U.S. Department of Commerce.

All of this work has emphasized the valuable properties of copper in regard to resistance to corrosion in nearly all types of soil and supports a provisional conclusion expressed in a report of the Electrical Research Association that "copper, whether plain or tinned, is the best of the metals investigated from the point of view of resistance to (soil) corrosion."

Investigations have been in progress for periods of from 10 to 25 years. A new report on the subject has recently been issued by the U.S. National Bureau of Standards and a report on independent tests being carried out in this country will be published shortly. Arising out of these developments is the preparation of a British Standard specification for "Copper tubes."

Midland Association at Worcester

On Wednesday, July 17, members of the Midland Association of Gas Engineers and Managers visited Worcester. The occasion was the "Day" of the President, Mr. G. P. Mitchell, and it marked, too, the centenary of the Worcester New Gas Light Company, of which Mr. Mitchell is Director and Chief Engineer. On the Tuesday prior to the gathering a Centenary Dinner was held, an account of which pleasant and successful function we publish in the "JOURNAL" on this page.

During inspection of the Works on the Wednesday morning, Mr. John Stallard, Chairman of the Company, unveiled a tablet commemorating the centenary of the Undertaking.

Following the tour of the Works, the visitors were entertained at luncheon in Worcester's historic Guildhall at the invitation of the Directors of the Worcester New Gas Light Company, the chair being occupied by the President of the Midland Association, Mr. MITCHELL.

Sir FREDERICK J. WEST, K.B.E., proposing the toast of the Town and Industries of Worcester, said it was pecularly appropriate that toast should be included in the centenary celebrations of the Gas Undertaking because the policy and the activities of the town interpreted by members of its Council had a great bearing not only on the comfort and amenities of the domestic homes of Worcester citizens but also a great bearing on industry and a great bearing on the Gas Undertaking.

The MAYOR OF WORCESTER (Alderman Frank Bullock), responding, said the City of Worcester had great traditions which they would not find surpassed by any other place to which they might go to hold their conferences. They also had great tradition in trade and commerce, and gas was placed in the forefront. The gas-works had been enlarged and would enlarge still further. It had been a great undertaking of which the citizens were very proud.

Mr. G. C. PEARSON (President of the Institution of Gas Engineers) proposed the toast of the Midland Association of Gas Engineers and Managers. He said during the whole of his professional life he had been associated with the Midland managers and he had formed life-long friendships and found a great deal of mutual help. The Association was founded in 1880 by Charles Hunt at Windsor Street, and he would indeed have been a proud man if he could have seen how it would develop and become a power in the Industry. They would all remember the system of mutual aid arranged by the Government and operated during the war to help undertakings that might be blitzed. He had the honour to be appointed Gas Engineering Adviser and he could tell them that when any works was blitzed the mutual aid arrangements came into force smoothly. They would also remember that one of their ex-Presidents, Mr. Rendle, arranged the Gas Engineering Advisory Board which operated so successfully, and Dr. E. W. Smith, then occupying an honorary position at the Ministry of Fuel and Power inaugurated the system throughout the country.

The CHAIRMAN, responding, said the Association covered a very wide field and as President he appreciated very much the support which he had received during his year of office and particularly on that day. He expressed thanks and appreciation to his Chairman and co-Directors for their hospitality and his personal thanks for enabling him to take that high office. He appreciated the presence of a representative of the Ministry of Fuel and Power. He could only say for himself and his Company that they had received at all times courtesy and attention to everything they had placed before the Ministry.

Mr. J. STALLARD said it was a great pleasure to the Company to welcome the visitors and it was felt to be appropriate that Mr. Mitchell should preside at a gathering of his friends.

Mr. HUGH GAITSKELL, M.P. (Parliamentary Secretary to the Ministry of Fuel and Power), remarked that an indication of the war work performed in that neighbourhood was to be found in the increased gas consumption—an increase which they could glean from the very attractive booklet which the Worcester Gas Company had brought out to mark its centenary was over 50% during the war years. This was a matter on which they could pay Mr. Mitchell and Mr. Stallard a great tribute for the splendid work done during those years. He was very glad to hear Mr. Pearson's remarks about the Midland Association. Few people realized the immense importance of gas supply to the aircraft industry during the war; few members of the public, he was afraid, appreciated that the bomber programme was dependent on the necessary provision of gas for the various technical processes in that industry, and few members realized the immense difficulties and dangers of the situation in the Midlands. He was aware of the great part in surmounting these difficulties that members of the Midland Association had played; and he knew, too, how useful the mutual aid scheme to which reference had been made had proved to be. Continuing, Mr. Gaitskell said the Gas Industry nowadays was the basic processing industry for coal. Allusion had been made to nationalization. He appreciated the way in which they were celebrating the past 100 years, but perhaps for a moment he might look to the future. He must ask them to accept that the Government was going to nationalize the Industry. The history of control in the Gas Industry, of public control for a long period of years, was not a very encouraging one. They might think that a surprising thing for him to say, but he did not regard the control established under so many private Acts of Parliament for that Industry as having produced the best results. Then any unbiassed observer would, he thought, agree that if they were to have a Gas Industry which was technically and commercially as efficient as it could be, they must have larger units of production and distribution. They had, of course, the authority, if they so regarded it, of the Heyworth Report for that; but he should add that the Government was in no way committed to accept the details of the plan put forward in that Report, and they would be very happy to consult with those in the Industry when the time came before nationalization was actually introduced.

During the afternoon a tour was made of the Malverns and a visit paid to the ancient earthworks of the British Camp.

A Hundred Years' Service

Worcester New Gas Light Company on Tuesday of last week celebrated the completion of 100 years of service to the public. They marked the occasion by unveiling a tablet at their works; by publishing a fine brochure describing the past history and present work of the Undertaking; by having their Managing Director and Chief Engineer in the Presidential Chair of the Midland Association, and by offering lavish hospitality to one hundred guests at dinner in the Guildhall, Worcester.

Mr. John Stallard and his fellow-Directors welcomed the guests, who included the Bishop of Worcester, the Mayors of Worcester, Droitwich, and Kidderminster, Sir Frederick J. West, K.B.E., Col. C. M. Croft, Past-President of the Institution of Gas Engineers, and Mr. R. Kelf Cohen, Permanent Under-Secretary to the Ministry of Fuel and Power.

Immediately following the Loyal Toast, Mr. George Mitchell, amid great enthusiasm, presented a silver cigar casket (fully charged) to the Chairman, whose family had been associated with the Company from its foundation, who joined the Board himself in 1881, and who at the age of 89 continued to bring a vital business mind to bear on the affairs of the undertaking. The toast of the Company was then proposed by Sir Chad Woodward, J.P., Chairman of the Worcestershire County Council, and in reply Mr. Stallard referred to the remarkably small capital of the Undertaking (not more than £65 per million cu.ft. of gas sold). They had always believed in working for the consumers. Fifteen years ago they were having a lean time, but then Mr. Mitchell came, practically rebuilt the works, and rapidly brought things to their present high state of efficiency.

The toast of the Gas Industry was proposed by Dr. E. W. Smith, C.B.E., President of the Institute of Fuel, who reminded the guests that the Gas Industry consisted not only of Boards of Directors, Engineers, Administrators, Consumers and Contractors, but also the Ministry of Fuel and Power. Judged by individual undertakings the Gas Industry was remarkably efficient, but in general it was a conglomeration of units bound, certainly, by common interests and social contacts but without integration. He considered that integration should take place not by dividing the country into squares, but by noting which were the nuclear undertakings and then perhaps setting up District Boards to implement the developments of these nuclei. Each Board should feel it stood or fell by the success of its undertakings. As for the present uncertainty of which many complained, let all assume that nothing was going to happen, and in the interim carry on their jobs to the best ability and for the best of all concerned. Doubts over coal were forecast, but here he thought that the storm could be weathered because all engineers could rely on the help of their neighbours. Dr. Smith closed by referring to Calor gas, and censured the Gas Industry for turning its back on such a development—merely a matter of organization. In his opinion "gas by almost any means" could work out cheaper than electricity. In replying to the toast, Col. Croft incidentally mentioned that Calor gas was used by his Company all down the Thames and up the coast to Newcastle; and it was much appreciated in their colliers.

Mr. R. Kelf Cohen followed the Bishop of Worcester in replying to the toast of the guests, regarding it as a privilege on the assumption that the majority of the guests were leading members of the Gas Industry. For the four years of its life, the Ministry of Fuel and Power had tried to co-operate with the Gas Industry; and, as Civil Servants, his Department had always tried to put on their instructions the interpretation most favourable to those who worked the gas undertakings.

In the course of the evening, everyone present received a memento in the form of a Royal Worcester ash-tray suitably inscribed and bearing a portrait of William Murdoch. The Directors and officers of the Company can be satisfied that they presented a function where universal goodwill presided and one which will long remain a most pleasant memory.

In connexion with the Centenary the Company published a most attractive brochure detailing the history and achievements of the Company. The major part of this was included in Mr. Mitchell's Presidential Address—see "GAS JOURNAL" of April 17.

Centenary of the Chemical Society

The Chemical Society is to celebrate the centenary of its foundation in July, 1947. But for the war the celebrations would have taken place in 1941, for it was on Feb. 23, 1841, that 25 gentlemen interested in the prosecution of chemistry met together at the Society of Arts to consider whether it be expedient to form a Chemical Society. These gentlemen did deem it expedient and so the Chemical Society was born. It was the first Society formed solely for the study of chemistry and although there had been small private chemical societies before 1841 none lasted for any great length of time. At its first general meeting Thomas Graham, the most distinguished chemist of his time, the pioneer of colloid chemistry and a discoverer of much important new chemical knowledge, was elected the first President.

The Fellowship of the Society has grown from those to over 6,000. The study of chemistry as a whole has remained its object; because of this the Society has always maintained a special place in the world of chemistry. It has not pursued the purely professional nor has it specially fostered industrial chemistry, although may great industries have been based on fundamental discoveries made by its Fellows. The professional affairs of chemists are now the province of the Royal Institute of Chemistry (founded in 1877) and industrial chemistry is the concern of the Society of Chemical Industry (founded in 1881). Both these organizations were offshoots of the Chemical Society, as were other societies specializing in sub-divisions of the subject. To-day some of these offshoots, having meantime grown in stature and importance, are again joined with the parent body in the Chemical Council, which consists of representatives of various chemical organizations and through which chemical industry and individuals subscribe to provide assistance in the publication of chemical research and information. Success has from the first attended on the Chemical Society and has been due almost entirely to the ready means it has provided chemists of publishing their discoveries and affording them a place for discussion and mutual interchange of ideas.

Further Training and Education

We have already referred in the "JOURNAL" to the Intensive Courses arranged by the Institution of Gas Engineers which are being run at Bournemouth and Birmingham under the Government's Further Education and Training Scheme.

We learn that arrangements have now been made to start a Course at the Brighton Technical College in Gas Engineering (Manufacture) or (Supply) on Sept. 19, 1946. The Course is intended for students who have had little or no previous training in Gas Engineering and is designed to enable them to reach the Ordinary Grade standard by May, 1947. A period of practical training with a gas undertaking will follow and a further full-time period at the Technical College, commencing in September, 1947, will take the students to the Higher Grade standard by May, 1948.

The portion of the Course relating to the Ordinary Grade Certificate will have the following timetable:

Sept. 19, 1946-Dec. 18, 1946.
Jan. 6, 1947-March 28, 1947.
April 17, 1947-May 31, 1947.

At the conclusion of the Course students will be required to pass examinations in ancillary subjects set by the College and in the main subject of Gas Engineering (Manufacture) or (Supply) set by the Board of Examiners of the Institution of Gas Engineers.

The following subjects will be studied:

Gas Engineering (Manufacture) or (Supply)	6 hours per week
Mathematics to S2 standard	5 " "
Engineering Science to S1 standard ..	4½ " "
Engineering Drawing to S2 standard ..	6 " "
Chemistry to S2 standard	6 " "
Physics to S1 standard	5 " "

The cost of this portion of the Course will be £35 excluding text-books, which will cost approximately £10. There will be no fees for examinations in ancillary subjects but a fee of 7s. 6d. will be charged for the main subject examination.

Intending applicants should communicate without delay with the Principal of the Brighton Technical College, Dr. G. E. Watts, M.A., B.Sc., F.R.I.C., at Richmond Terrace, Brighton, Sussex, and advise the Institution of Gas Engineers that they have done so.

The College Authorities have intimated that they will do their best to assist candidates in finding suitable accommodation and should applicants take advantage of this offer they should communicate with the Registrar of the Brighton Technical College as soon as the application to attend the Course has been accepted by the Principal of the College.

Awards are payable under the Further Education and Training Scheme to persons who are eligible to cover the cost of the Course, the cost of necessary text-books, examination fees, and maintenance.

This Course is designed to enable students to obtain the High Grade Certificate in Gas Engineering (Manufacture) or (Supply) which is the academic requirement for Associate Membership of the Institution of Gas Engineers, by full time training, and students desiring to take advantage of it should enrol for the whole Course. Applications to attend a portion only of the Course will not be considered by the Ministry of Labour and National Service for awards under the Further Education and Training Scheme.

The details of the period of practical training and of the Course for the Higher Grade Certificate are not finalized but students will be advised of these details in due course. The cost of the Higher Grade Course is expected to be the same as for the Ordinary Grade Course, except that the examination fee is 10s. 6d. instead of 7s. 6d.

Clacton Recovers its Pre-War Load

A new gasholder and exhausters at the works of the Clacton-on-Sea Gas Department were officially inaugurated on July 5 by Captain E. R. Pennell, Chairman of the Council. A large company of visitors inspected the works, and were afterwards entertained to tea at the Town Hall, where Mr. F. N. Howes, President of the Eastern Association of Gas Engineers and Managers, congratulated the Council, Mr. F. Allen, Engineer and Manager, and the contractors on the remarkably short time in which the reconstruction of the holder had been achieved.

In a survey of the history of the undertaking, Mr. Allen said the vicissitudes of the war period were reflected in the fortunes of the Gas Department. The output of gas was maintained in the first few months of war, but in July, 1940, it had fallen to approximately 220,000 cu.ft. per day against a record day's output in August, 1939, of 1,154,000 cu.ft.

Gas outputs during the war years illustrated the difficulties faced by the townspeople of Clacton, and the neighbouring towns of Frinton and Walton, whose gas supply came from the Clacton works. The figures in millions of cu.ft. at the end of the financial year, March 31, were 1939, 235.103; 1940, 232.076; 1941, 123,074; 1942, 125,365; 1943, 127,069; 1944, 156,493; 1945, 186,632; 1946, 207,934.

The war situation in 1940 necessitated considerable evacuation of the normal inhabitants of the coastal area and from its geographical position it was obvious that Clacton could not expect immunity from air attack. On April 30, 1940, the town suffered the first major incident in Great Britain, when a German mine-laying aircraft exploded in a residential area, and various incidents were suffered between that date and Feb. 22, 1945, when damage caused by an enemy rocket bomb on the Marine Parade East marked the end of that class of warfare.

Most air attacks caused some damage to property of the Gas Department. Mains, service pipes, meters and appliances were damaged, but on no occasion was there general interruption in the gas supply.

On Jan. 5, 1941, the gas-works suffered a near miss from a large bomb which fell on the car park adjacent. The larger holder was holed by shrapnel, and the escaping gas ignited. It was with pleasure and pride that they recorded the award of the George Medal to one of the department's employees, Mr. Charles Higgs, for his work in extinguishing the flames.

The smaller two-lift holder suffered severe damage from the concussive shock of that explosion. It was split circumferentially, and for the rest of the war could only be used at half its normal capacity.

Clacton's marvellous and rapid recovery from the effects of war were reflected in the output of the Gas Department. In the first three weeks of June, 1946, output exceeded that of the corresponding period of 1939 by 5,000,000 cu.ft., an increase of 34½%, and for the first time more than 1,000,000 cu.ft. had been sent out during a day in June. Pre-war that quantity was not usually sent out in one day before the height of the season, in August.

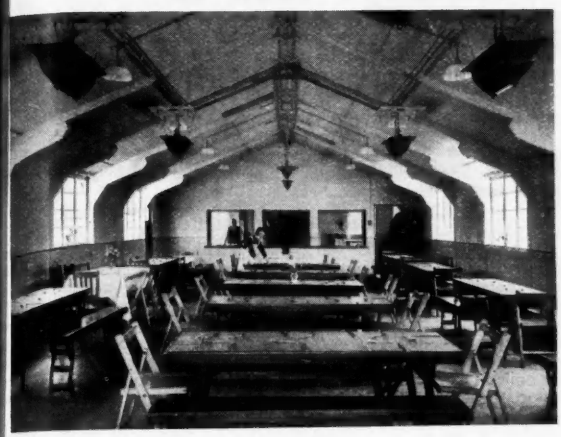
The Council foresaw the probability of that rapid recovery when, in October, 1944, they decided to apply to the Ministry of Fuel and Power for permission to reinstate the damaged two-lift column guided gasholder with a three-lift spiral guided holder and to install new and larger gas exhausters. After some delay permission was given for the work, and demolition of the old holder and building of a new holder was entrusted to C. and W. Walker, Ltd., Donnington, Shropshire.

The old holder was taken out of commission in October, 1945, and the site handed over to the contractors in November. The holder was completed and ready for filling and painting in May.

The exhausters, purchased from George Waller and Sons, Ltd., Stroud, were ready for work in May, and were working in an eminently satisfactory manner.

The holder was of the spiral-guided type and had a capacity of 270,000 cu.ft.

Overhead Heating for Infants' Schools



Overhead gas heaters are now being installed in many infants' schools in the country. Being out of reach of the children, and controlled outside the room, all risk to the children is avoided. Also, the full utilization of available floor space is allowed. They are being installed by local gas undertakings in collaboration with the Ministry of Works. Our photograph shows the canteen of the Montgomery Primary School at Exeter. Two hundred and fifty mid-day meals a day are served here, and meals are distributed to other schools in the area from the seven gas-heated ranges in the kitchen.

Cast Iron Street Lighting Columns

The British Standards Institution has issued a specification for Cast Iron Street Lighting Columns, B.S. 1249. The specification provides for columns for gas and electric lighting suitable for four groups of lighting classes giving a light source at approximately 30, 25, 15, and 13 ft. above ground level.

The construction and design of the column is specified and the weight of the column and permissible deflection of the column, together with the method of carrying out the deflection test. The design of this column has been submitted to the Fine Arts Commission and has received their approval. Copies may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s.

Resettlement Courses in Illuminating Engineering

Illuminating Engineering has been accepted as a suitable subject for the resettlement courses sponsored by the Ministry of Labour and National Service. The first course of this kind has been taking place at the Borough Polytechnic (Borough Road, S.E.1), and is about to be concluded. It is anticipated that this will be followed by a somewhat more complete course (probably nine to ten months), to commence in September next.

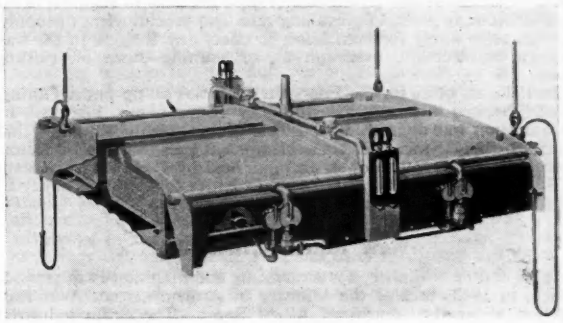
The initial course appears to have been quite successful. Approximately 20 students who have passed through the course are now seeking employment in the lighting industry. It is advantageous for such firms to engage applicants who have acquired some knowledge of the principles of illminating engineering, and no doubt some of these will wish to avail themselves of the opportunity of recruiting assistance. Further particulars can be obtained on application to Mr. C. E. Greenslade or to the Illuminating Engineering Society, 32, Victoria Street, S.W.1.

The First All-Welded Gasholders built in South America were recently erected at Volta Redonda, Brazil, for the Brazilian National Steel Co., by Stacey Bros. Gas Construction Co., of Cincinnatti. The larger of the two has 5,000,000 cu.ft. capacity and is used for storage of blast furnace gas, while the other 1,000,000 cu.ft. holder is used for "bubble" on the line. The piston construction is such that uniform pressure of the amount of gas stored can be maintained at all times. Approximately 5,300,000 lb. of steel were used in the construction of these holders and all field operations were conducted by local labour.

Radiant Heating in the Textile Industry

The Ford Motor Company started the industrial application of a new method of rapid heating when they reduced the time taken to to dry paints from many hours to a minute or so and thus made an important advance in mass production technique. This method was known as radiant heating.

A recent application of this technique to the textile industry is the curing of materials coated with polyvinyl chloride. A use of this valuable plastic is in making textiles water-proof and crease-resisting. Cotton and other fabrics may be coated with polyvinyl chloride, appropriately coloured, and on being subjected to heat the plastic partly decomposes with loss of some volatile matter to form a smooth, glossy, water-proof, and crease-resisting surface. The problem of how to bring about this change quickly has been solved by radiant heating. Gas-fired radiant heating panels enable materials of all colours, together with the two extremes, black and white, to be processed in what, for all practical purposes, is the same time. The curing times are short, varying between a half and three minutes, at a panel temperature of 650° F., depending on the weight and thickness of material, and the process lends itself admirably to continuous production. The finished materials, which can be produced in a great variety of colours and black and white, in various thicknesses, will be required for water-proof curtains, furnishing fabrics, and upholstery, materials for the manufacture of wallets, handbags, travelling bags, &c.



The heating panel, which is shown in our photograph, consists of a row of gas burners firing into a combustion chamber on one side of which is the hot radiating panel and on the other an insulated backing block to retain the heat. The heater is made up of two units each with a radiating panel 2 ft. 4 in. by 3 ft. 5 in.—*i.e.*, making one unit 4 ft. 8 in. by 3 ft. 5 in. Thirty-two No. 0 industrial jets at 1 $\frac{1}{16}$ in. centres fire horizontally along each side of the 4 ft. 8 in. length.

Tests have been made on curing fabrics coated with polyvinyl chloride in which materials coated with both black and white plastic were run underneath the panel at a temperature of 650° F. and at a distance of 3$\frac{1}{4}$ in. from the edge and 5$\frac{1}{4}$ in. from the centre (allowing for the curvature of the panel). The fabric cured successfully at a rate of travel of approximately 2$\frac{1}{4}$ ft. per min. Other lighter fabrics have been cured at a rate of up to 10 ft. per min.

Thermal Insulating Materials

The British Standards Institution is preparing a series of specifications for thermal insulating materials, embracing pre-formed, plastic, granular, and loose-filled types.

The first of this series is B.S. 1304, and carries the title: "Ready-to-fit" Thermal Insulating Materials for Hot and Cold Water Supply and Central Heating Installations for dwellings with a water heater rated at not greater than 40,000 B.Th.U. per hour. It is intended for use in connexion with small dwellings, and it is hoped that its issue will assist manufacturers in the mass production of materials suitable for this purpose.

The fuel saving to be achieved by the installation of thermal insulation in such dwellings is emphasized in an appendix. A list of suitable materials with information concerning thermal conductivity is also given.

Copies of the above specification may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, at 2s. each.

Renfrew Gas Department has applied to the Ministry of Fuel and Power for an extension of plant but has been instructed to ascertain first of all if the extra gas required could not be supplied from Johnstone or Paisley. The engineers of the three undertakings concerned are to consider the technical possibilities of a link-up and are to submit a draft report at an early date to the constituent authorities.

The Gas Industry in Germany: 1939-45*

By H. D. GREENWOOD

Controller (Gas), Public Utilities Branch, Control Commission for Germany (British Element)†

WHEN the Nazi party came to power in 1933, there was no Reich Authority responsible for gas supply. In 1934, German economy was organized within a framework of industry and trade, under the ægis of the Ministry of Economics, and since more than 80% of gas undertakings were publicly owned, there was no difficulty in bringing the Gas Industry under the control of the State.

This organization of industry and trade was divided into appropriate industrial groups, of which public gas, water and electricity undertakings formed one group for power economy. This in turn was divided into two groups for electricity supply, and gas and water supply respectively. The group for gas and water supply—"Wirtschaftsgruppe Gas- und Wasserversorgung" (W.G.W.)—was based on the Association known as the German Association of Gas and Water Engineers—"Deutscher Verein von Gas- und Wasserfachmännern" (D.V.G.W.)—to which most of the gas undertakings already belonged. The W.G.W. was compelled by law to inform the head of the group for power economy of the state of manufacturing and distributing plant, of prevailing rates and general terms of supply, as well as to apply for permission to effect any changes in the way of new construction, extension to, or shutting down of, existing plant.

In 1936, an office for the Four-year Plan was set up under Göring, which became the supreme authority in economic matters. Its organization was divided into business groups, plenipotentiaries, and special trustees. Included in the plenipotentiaries, was the Inspector-General for Water and Power, an office held by Todt until his death in 1942; he was directly responsible to Hitler for deciding policy in all matters relating to water and power supplies.

New Ministry in 1940

In 1940 a new Ministry for armaments and munitions was created, which, in 1943, became the Ministry of Armaments and War Production under the control of Albert Speer. The entire industrial production, including gas, thus came under his direction. Upon Todt's death, Speer assumed the title of Inspector-General for Water and Power but delegated the execution of that function to departments of his Ministry. One of these had been instituted in 1942 for developing power production programmes, determining coal, manpower and supply requirements, and for working out schemes of economy in the utilization of power. A special deputy for power saving, who operated through regional deputies, one for each of three gas districts, was appointed for effecting economy. These gas districts roughly corresponded to the following regions: (i) The Ruhr district, extending to Hanover (ii) Saar-Rhine-Main-Württemburg; (iii) Central Germany.

Within the broad assignments of the Inspector-General for Water and Power, allocations were made from the gas district offices to consumer groups according to their war importance. Allocations to particular industrial consumers, however, were made from regional and local economic offices, where responsibility was held for the enforcement of all regulations, and the imposition of penalties on any consumer who exceeded his quota. The total administrative personnel of municipal gas-works and combined gas and electric power organizations numbered about 7,500. Under the Nazi régime managements were systematically purged; although most managers were technicians, they had also to be "reliable" Nazis.

Emergency Measures for Maintaining Production

The development of gas supply during the war was governed by the following factors:—

(i) The steep rise in industrial consumption.
(ii) Inadequate supply of basic raw materials, due, on the one hand, to a lack of suitable hard coal with which to meet total fuel requirements, and on the other, to the transportation difficulties.
(iii) A deficiency in gas-producing plant, gasholders and grid gas mains on account of war damage.
(iv) The constant re-shuffle of gas consumers as a result of the erection of new, and the removal of existing, industrial works, and the evacuation of the civil population.

Authoritative measures were, therefore, introduced in order to increase production, restrict coal consumption, evolve raw material substitutes, and to control gas consumption. These were the main objectives; the means by which they were achieved varied from one district to another.

Increased Production

At the outbreak of the war, it was possible to step up production by normal means of utilizing existent capacity to the full. In the same way, the supply of grid gas from coke ovens at the collieries could be increased, because the use of rich gas for underfiring was still in practice at a large number of coke ovens. Normal development was also maintained by constructing central generator plants, so that low-grade gas could be used for underfiring. The use of rich gas for boiler firing was discarded in favour of its utilization for more important purposes. Although extension of the grid gas network did not result in the distribution of increased quantities of gas, it facilitated the distribution of the total gas available by connecting up the various gas-producing plants.

Restriction of Coal Consumption

As the war pursued its course, coal production could meet neither the general nor the gas-works' demands. In 1943-44, the maximum amount of coal allowed to gas-works, which was determined on a monthly basis by the regional economic offices, was subject to restriction, but the way was still open for those gas-works supplying new and more important factories to receive, upon request, an extra allowance of coal. Gradually, however, the coal situation deteriorated, and on Oct. 28, 1944, the Inspector-General for Water and Power decreed that:—

> "With immediate effect, the coal consumption of all local gas-works must be reduced by at least 15%, that is, not more than 85% of the maximum amount allowed per month may be consumed, until further notice."

Soon the ration for gas-works had to be further reduced. By a decree of Dec. 3, 1944, the following minimum quantities were conceded to gas-works:—

> "For local gas-works in the west, 50%; local gas-works in the east, 85%, and local gas-works connected to the central German grid gas network and supplied with coal from Upper Silesia (including Berlin), 100%."

A fortnight later, these concessions were still further reduced and based either on minimum or on standard rates, according to the coal supply position. Standard rates were 70% of the maximum amount allocated to gas-works in the west, and 80% for those in the east. Minimum rates were 50% of the maximum amount allocated to gas-works in the west, and 70% for those in the east. On Feb. 5, 1945, the Inspector-General was compelled to admit that coal for gas-works would only be available in small quantities, and that in many cases there would probably be no further allocations. Thus the Government officially recognized the complete breakdown in the supply of coal to the gas-works, and there remained no alternative but raw material substitutes, the supply of which was in many cases totally inadequate.

Raw Material Substitutes

With the breakdown in deliveries of gas coal at the end of 1944 poor-caking Upper Silesian coal was used as an alternative, but with the constant deterioration of the transport situation, these deliveries ceased, and it was necessary to employ various substitutes. The first of these were brown coal briquettes which were used both in producers and in place of gas coal. Raw brown coal was also used, but suitable material of this type, *i.e.*, well-matured and of low water content was only available in a few places. On Jan. 25, 1945, a decree of the Inspector-General stipulated that:—

> "Gas production must be maintained as long as possible by the utilization of alternative fuels, *viz.*, brown coal briquettes, wood, charcoal, bark, tanbark, &c."

No regard was to be paid to quality nor to caking-power, and all extra labour involved was to be drawn from those works which were temporarily at a standstill. Further, existing stocks of coal in the district, particularly at those factories which were not on essential war work, were to be requisitioned for gas-works. At the end of January, 1945, gas-works were recommended, by switching over from carbonization to gasification, to produce water gas and producer gas from surplus coke. In some gas-works, oven coke was used. It was interesting to note that in connexion with these emergency measures, the German Association of Gas and Water Engineers (D.V.G.W.) collected much useful technical and practical information, which was issued as instruction pamphlets to the Industry.

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* From "The Gas Industry Overseas, 1939-45." Communication No. 299 of the Institution of Gas Engineers.

† Acknowledgment is made to the Deputy Chief of the Trade and Industry Division, Control Commission for Germany, for permission to publish this Paper.

Control of Gas Consumption

In December, 1944, the Minister of Armaments and War Production decreed that industrial consumption for armaments should take precedence over domestic consumption. A number of measures were introduced to restrict the consumption of gas, some applicable to the gas-works, others to the consumer himself. In most cases, their practical achievement was left to the discretion of the local authorities, since conditions varied from one place to another.

In 1938-39, the increased production of gas brought about a revised specification for its quality. Whereas, previously the gross calorific value of town gas had been between 450 and 483 B.Th.U. per cu.ft., town and grid gas together were established at 470 to 515 B.Th.U. per cu.ft. Town gas from local gas-works varied between 470 and 483 B.Th.U. per cu.ft.

On Feb. 8, 1943, an Order was issued by the Inspector-General, instructing gas-works to reduce the gross calorific value of the gas supplied by the addition of producer gases or by steaming the ovens, but benzole extraction was to be maintained. The gross calorific value was not to be reduced below 450 B.Th.U. per cu.ft. Exceptions to this rule were those gas-works which were connected to the grid gas supply, and gas-works whose consumers would have encountered severe difficulties in attempting to run their plants on a reduced calorific value.

This Order was originally issued to cover one year (May, 1943, to June, 1944), but was extended until June, 1945. In the meantime, conditions had deteriorated so rapidly that by the end of January, 1945, the Inspector-General permitted the gross calorific value to be reduced below 425 B.Th.U. per cu.ft. in order to maintain the gas supply, while in February, 1945, all restrictions on calorific value were removed.

Rationing

Although in the summer of 1943, orders given for a reduction in power consumption included local restriction on the supply of gas for domestic use, it was not until the autumn of 1944 that any serious measures became necessary. In a Decree issued on Sept. 26, 1944, regulations for economy in gas consumption included, where they were available, alternative methods to gas for space and water heating, and for cooking in houses, trade, industry and agriculture, as well as cutting off the gas supply entirely in purely residential areas.

In connexion with the Decree of Oct. 28, 1944, for a reduction of 15% in the coal supply to gas-works, the following reductions in gas consumption were ordered:—

> "In accordance with the decision of the Power Allocator or of the Works Manager of a gas supply undertaking, an average reduction of 20% in the current domestic gas consumption is to be effected. In cases where this reduction fails to implement the 15% reduction in coal, it must be increased to 30%. If this is still insufficient, then restrictions must be imposed on industrial, trade and vehicular gas consumption."

A further Decree on Dec. 7, 1944, supplemented the measures previously outlined and differentiated between the types of domestic consumer. Priority was given to domestic cooking load. For instance, smaller reductions were applied to those who depended on gas for cooking, whilst on those who possessed geysers, gas refrigerators, &c., a higher rate of reduction was imposed. Moreover, consumers whose former consumption had been particularly high, say, 10,000 to 15,000 cu.ft. a month, were reduced by 50 to 60%.

On Jan. 5, 1945, local gas supply allocators were appointed, whose duty it was to see that the restrictions were put into force. As the position became more critical, gasless periods of anything from a few hours to a week were ordered in the endeavour to reduce consumption by 50%. These gasless periods were only technically possible when there was sufficient storage capacity. Where essential trade and industrial consumers were supplied from the same mains as domestic consumers, householders or A.R.P. officials had instructions to see that the gas was turned off during gasless periods, an experiment which was sucessfully carried out in Hamburg and Vienna. Some works supplying essential war industries, whose stocks of coal were only sufficient to last ten days, were ordered to introduce gasless weeks at once. These drastic measures showed only too well that towards the end, Germany's domestic gas supply broke down completely.

An example of how the various measures for economy in gas consumption were put into effect is given in the following ration scale which was applied in a town in Thuringia:—

TABLE 1.—*Domestic Weekly Maximum Consumption of Gas*

No of Persons	Households with Coal Ranges or other Means of Cooking than Gas (cu. m.)	Households without Coal Ranges or other Means of Cooking than Gas (cu. m.)
1	1	4
2	2	5
3	3	7
4 or 5	4	9
6 or 7	5	10
8 or more	6	11

(1 cu. m. = 35.31 cu. ft.)

Extra allowances were given for various classes of consumers. Gasless days were put into practice in Hamburg, when the mains supply was cut off at 7 a.m. and not turned on again until 4 a.m. the next day. The responsibility for safety measures rested with the A.R.P. member for each house. These gasless days were established regionally, each region taking its turn at closing down once a fortnight.

In order to simplify the office work of the supply undertakings, they were instructed by the Inspector-General to institute four-monthly instead of monthly meter readings. Slot meters were to be converted into ordinary meters, so that consumption could be calculated on a normal tariff basis. Also, where practicable, inclusive accounts were to be made out for gas, water and electricity. These instructions, however, only served to complicate the control of gas consumption, since, to be effective, more frequent meter readings by trained staff were necessary. Thus the German Government was in the anomalous position of weakening the effect of its emergency decrees by the very instructions which it issued for their practical application.

Air Raid Precautions and Regulations

Experience proved that the most vulnerable parts of the gas supply system were gasholders and distribution mains in built-up areas. The carbonizing plants themselves, although in many cases seriously damaged or even completely destroyed, were capable of being more effectively protected.

In general, the technical precautions against air attacks were similar to those adopted in England, *i.e.*, protection of plant against blast, provision for dealing with incendiary bombs, &c. The distribution systems were sub-divided by fitting additional valves and providing for sealing off small sections of the mains. The probability of mains becoming waterlogged was not overlooked, and special precautions were taken to deal with this as expeditiously as possible. Additional mains were laid to complete ring main systems and to ensure supply from any direction.

Special measures were taken for the operation of distribution systems without gasholders. This was apparently very necessary in view of the fact that practically all the holders of any size were out of commission at the end of 1944. The use of high-pressure grid system allowed considerable storage of gas in the grid, which was a great advantage in the absence of holder capacity. A large proportion of the gas consumed in late 1944 and early 1945 must have been distributed without holders, and few works were found with adequate gasholder capacity when the country was occupied.

A further measure was to arrange for different consumer groups to use gas only at specified times, thereby ensuring uniform distribution of the load throughout the day. For example, in Hamburg in 1944, the maximum load in one day was 1.3 mill. cu.ft. per hr. at 1 p.m., and 1 mill. cu.ft. per hr. at 2 a.m. It will be clear from this that many factories were only working during the night hours.

In most towns, public lighting was prohibited. In Hamburg this resulted in so many accidents, that a special form of street lighting was designed, giving an effect similar to our "starlight" illumination. In Germany, this was obtained by the inefficient method of heating a wire spiral with naked flame.

No satisfactory method of lighting gas-works during air raids appears to have been devised, but towards the end of the war a system was organized whereby all gas-works obtained fore-warning of air raids, and charging operations, &c., were suspended.

Emergency Repair Service

An emergency repair service was organized under the auspices of the W.G.W. For this purpose, a group leader for gas (in many cases combining the interest of water in one individual) was appointed to each of 19 regions covering the whole of Germany. Subordinate to the group leader were four or five watchers or "reporters," each responsible for a clearly defined area. Gas-works in each area pooled their resources in labour and material, and repair gangs were organized into flying squads. Stocks of tools, pipes, &c., were well distributed throughout the area for rapid accessibility in case of emergency.

When there was an air raid, it was the duty of the watcher to report the amount of damage and the extent of interference with production in his area to Berlin, either direct or *via* the group leader, as well as to the local A.R.P. warden and, in the case of damage to water-works and mains, to the local sanitary inspector. The efficiency of this repair organization must have been high, since up to the last few months of the war, repairs were executed in remarkably short time.

Gas Production and Consumption in Greater Germany* during the War

A large proportion of the gas supplied in Germany was obtained from coke oven plants, these being situated in three regions: the Ruhr, the Saar, and Upper Silesia, of which the output from the Ruhr constituted about 70%. In order to get a general picture of the development of the gas supply, it is necessary to examine the production and distribution of gas from both coke ovens and gas-works. Coke

* This includes Austria, Sudetenland, and Luxembourg. Separate figures for Germany alone are not available.

oven gas was sold (i) direct to large industrial consumers; (ii) to grid gas companies (*e.g.*, Ruhrgas A-G.) for distribution to industrial consumers, or in bulk to municipal gas undertakings.

The grid gas companies also "carried" gas from one point to another, but without actually purchasing it. This practice is strange to the Gas Industry in Great Britain, and it is difficult to coin a name for the gas handled in this way. Where it occurs later on in this Paper, it will be called by its German name, "Durchleitungsgas."

Production at the coke ovens was 780,351 mill. cu.ft., to which 91,806 mill. cu.ft. were introduced from other sources, such as blast furnaces, giving a total quantity of gas available of 872,157 mill. cu.ft. Nearly half this quantity was used for heating the ovens at the blast furnaces and other plants whence the additional gas was obtained.

This left 462,561 mill. cu.ft. available for distribution to consumers, and was supplied either direct to industries and gas undertakings or was sold to grid gas companies and supplied by them to industries and towns.

The quantity supplied direct to industries was 338,976 mill. cu.ft., of which 74,151 mill. cu.ft. was "Durchleitungsgas." About 105,930 mill. cu.ft. were bought by the grid gas companies for sale to towns and industry, and 17,655 mill. cu.ft. sold direct to gas undertakings.

Of the total quantity of gas supplied by gas undertakings, 155,364 mill. cu.ft. were manufactured at gas-works, 45,903 mill. cu.ft. bought from grid gas companies, and 17,655 mill. cu.ft. bought direct from coke ovens.

Gas from Coke Oven Plants

While the total output of coke oven gas has not greatly increased, the quantity supplied to the grid system increased from 135,414 mill. cu.ft. in 1939 to 193,569 mill. cu.ft. in 1942.

As the demand for gas by industry increased during the war, rich gas for heating the ovens was replaced by blast-furnace gas and producer gas, resulting in a greater quantity for disposal. During this period, additional coke oven plants were connected to the grid, and additional producers installed for heating the ovens. Towards the end of the war, the large coke oven plant of the Hermann Göring Steelworks was brought into operation, from which 26 mill. cu.ft. per day were supplied to Berlin, 250 miles away. There was a definite shortage of coke oven gas, and an attempt was made to meet this demand by the erection of producers at industrial factories in place of using coke oven gas. A further alternative was the complete gasification of coal, but this does not appear to have progressed beyond the experimental stage, except in the case of brown coal by the Lurgi process.

From the following table, it will be seen that there was a considerable increase in the quantity of gas both bought and "carried" by the grid gas companies throughout Germany. Gas unaccounted-for, as a percentage of total gas bought, is low in comparison with the present-day figure for the Ruhr grid, which is in the region of 10%.

TABLE 2.—*Gas Bought and "Carried" by German Gas Grid System*

Gas Supply Categories	Year 1939 Mill. cu. ft.	1940 Mill. cu. ft.	1941 Mill. cu. ft.	1942 Mill. cu. ft.
"Durchleitungsgas"	49,222	64,335	69,808	74,504
Gas bought by Grid Gas Companies	86,192	87,922	99,186	119,065
Total Gas	135,414	152,257	168,994	193,569
Unaccounted-for Gas (included in above figures)	741	3,001	2,684	2,931
Unaccounted-for Gas (Percentage of Gas bought)	0.9	3.5	2.7	2.4

The coke oven gas supplied to the various industries, either direct or by the grid gas companies, is given in the following table:—

TABLE 3.—*Industrial Consumption of Coke Oven Gas in Greater Germany*

Type of Industry	1941 Mill. cu. ft.	1941 Per cent.	1942 Mill. cu. ft.	1942 Per cent.	1943 Mill. cu. ft.	1943 Per cent.	1944 (Jan. to June) Mill. cu. ft.	1944 (Jan. to June) Per cent.
Iron and Steel ...	222,347	73.7	230,186	72.5	233,717	70.8	127,610	73.0
Non-ferrous Metals ...	8,616	2.9	8,368	2.6	6,497	1.9	4,096	2.3
Chemical	48,516	15.7	56,391	17.8	67,160	20.4	32,944	18.8
Glass and Ceramics ...	12,676	4.4	13,206	4.2	12,641	3.7	5,791	3.3
Power Generation	9,216	3.3	9,322	2.9	10,205	3.2	4,555	2.6
Total ...	301,371	100.0	317,473	100.0	330,220	100.0	174,996	100.0

It will be noted that the metallurgical industry consumed more than 70% of the total, the bulk of this being concentrated in the Ruhr. Further, during the last years of the war, there was little change in the distribution of gas to the different industries. Statistics are not available for the total supplies of coke oven gas to industry before the war, but the sales of Ruhr gas to industry given in the following table are of interest:—

TABLE 4.—*Industrial Percentage Consumption of Ruhr Gas: a Comparison*

Type of Industry	Consumption 1939 Percentage	1944 Percentage
Iron and Steel	72.4	65.3
Non-ferrous Metals	6.6	4.7
Chemical	8.0	13.3
Glass and Ceramics	3.1	1.6
Power Generation	—	—
Other Industries	0.7	1.4
Towns	9.2	13.7

Gas from Gas-works

The variations in production of gas from gas-works and in coal consumed are shown in the following table, from which it will be seen that the output rose from 130,647 mill. cu.ft. in 1938 to 173,725 mill. cu.ft. in 1943, an increase of 24.8%. This increase is due partly to the expansion of the German Reich, which accounted for about 40% of the total increase. The coal carbonized increased from 8.3 mill. tons in 1938 to 10.6 mill. tons in 1943, an increase of 21.7%. The gas distributed increased from 178,245 mill. cu.ft. in 1938 to 247,876 mill. cu.ft. in 1943, an increase of 39%.

TABLE 5.—*Gas-works Coal Input: Gas Output Comparison*

Year	Gas Produced (Mill. cu. ft.)	Coal Carbonized (Thou. tons)	Gas Distributed, including Coke Oven Gas (Mill. cu. ft.)
1938	130,647	8,300	178,245
1939	134,778	8,400	187,072
1940	152,998	9,700	213,555
1941	155,082	10,000	237,283
1942	172,419	10,500	251,584
1943	173,725	10,600	247,876

In the following table is shown the consumption of gas by different types of consumers in 1938 and 1942:—

TABLE 6.—*Consumer Analysis*

Consumer	1938 Per cent.	1942 Per cent.
Domestic	55	61
Trade and Industry	30	36
Street Lighting	10	0.5
Consumption on Works	5	1.9

Figures for later years are not available, but an indication of the trend of consumption can be obtained from statistics for individual towns, which are given in the following table:—

TABLE 7.—*Domestic Consumption*

Year	Hamburg Percentage Consumption	Frankfurt/M. Percentage Consumption	Dusseldorf Percentage Consumption	Smaller places Percentage Consumption
1939	100	100	100	100
1940	127	123	107	135
1941	130	140	107	144
1942	150	168	141	181
1943	103	162	143	267
1944	78	51	136	184
1945	34	(Practically no supply)	101	—

TABLE 8.—*Trade and Industrial Consumption*

Year	Hamburg Percentage Consumption	Frankfurt/M. Percentage Consumption	Dusseldorf Percentage Consumption	Smaller places Percentage Consumption
1939	100	100	100	100
1940	129	119	117	127
1941	145	149	131	164
1942	159	106	114	171
1943	126	121	111	195
1944	143	50	108	136
1945	40	(Practically no supply)	18	—

Sales of domestic gas decreased in most cases after 1943, whereas sales to trade and industry increased in some towns. The general tendency to concentrate supplies for industrial purposes at the expense of domestic consumers has already been discussed, but damage due to air raids renders particularized statistics unreliable. The large increase in domestic consumption in the smaller towns is accounted for by the evacuation from the larger towns and the dispersal of factories. The increase in gas consumption for industrial purposes is due not only to increased output from these factories, but also to the substitution of gas for oil, &c., for heating. Towards the end of 1944, domestic gas supply was severely restricted—*e.g.*, from October, 1944, no domestic consumers were supplied in Stuttgart, all available gas being delivered to industry.

Effect of Air Raids on Gas Production

Gas production increased up to 1943, although there had been a reduced output at works in certain large towns, owing to air attacks. The monthly production at gas-works was fairly constant during 1943 with the exception of a decrease in August, chiefly the result of the raid on Hamburg. From May, 1944, the production fell rapidly from the region of 12,000 mill. cu.ft. until by March, 1945, it had fallen to less than one-third of the peak figure.

In Austria, the position was similar, but production fell only to 50% of the maximum by March, 1945.

This decline in production was due to bomb damage starting from July, 1943, but was further accentuated from October, 1944, by shortage of coal.

It is of interest to note the effect of air raids in gas production in the larger towns in Germany. The maximum loss of output coincided with raids on Frankfurt and Berlin at the end of 1943. Up to the end of 1943, there was relatively light damage from air attack in the west of Germany. The first serious damage to gas-works was experienced in Hamburg at the end of July, 1943. By the beginning of 1944, 35 gas-works had been seriously damaged, the number increasing to 60 by the middle of 1944, and to 140 by March, 1945. It will be appreciated that these were in all cases large works, and, therefore, represented a considerable proportion of the total gas-producing capacity of Germany. In all cases, this reduction in output was due to air attacks and not to damage arising from land fighting.

Coke Oven Plants and Gas Grid Systems

The following figures from Ruhrgas A.-G., although only relating to part of the grid system of Germany, serve to indicate the effect of air raids on the output of coke oven gas and the quantity of gas distributed through the grids:—

TABLE 9.—*Ruhrgas A.-G. Sales: Air-raids Effects*

Ruhrgas A.-G. Sales Year	(Mill. cu. ft.)	Last Quarter of 1944 Month	(Mill. cu. ft.)
1942	110,414	September ...	10,593 (approx.)
1943	118,041	October	8,827 (approx.)
1944	109,461 (approx.)	November ...	5,296 (approx.)
		December ...	3,107 (approx.)

The present sales of Ruhrgas A.-G. are 2,295 mill. cu.ft. a month.

During 1940-43, the extent of damage to the mains network of Ruhrgas A.-G. was such that it could be speedily repaired, the average time considered necessary being about eight hours for each break. In 1944, bomb damage to the mains was more severe, but it was still such that it could be mastered in a relatively short time. Although air attacks were concentrated on benzole plants at coke ovens, all the plants were more or less severely damaged, and many batteries received direct hits. The last four months of 1944 saw a rapid decline in production as a result of still heavier attacks. Of the 75 coke oven batteries situated in the Ruhr, 56 were out of action, due to damage, in March, 1945. As an example of the damage to the grid gas system, it is estimated that there were about 400 breaks in the Ruhrgas system, and by the end of the war, practically the whole of this grid system was out of action. At the present time there are 1,419 miles of mains in operation and 360 miles yet to be repaired. With regard to the damage to distribution systems in towns, up to the end of 1945, 1,500 gas main repairs had been carried out in Dusseldorf and 409 in Hamburg: in Berlin, up to the end of June, 1944, over 4,000 breaks in gas mains had been reported.

Gasholders

Out of 48 M.A.N. holders in the Ruhr area, were 22 completely destroyed and 13 badly damaged, all the remainder having suffered some damage. Although statistics are only available for the British zone of occupation, these show that the present holder capacity is probably not more than 30% of the pre-war figure.

In a German report written in the middle of 1942, it is stated that a number of both types of holder had been damaged by high-explosive and by incendiary bombs, but in no case did this lead to an explosion sufficiently serious to damage adjacent buildings, with the exception of the wet holder at Tournai, which exploded as a result of artillery fire. Small explosions which led to destruction of the holders occurred in four cases to waterless holders and in three cases to wet holders, one of these being in Paris. With the exception of the waterless gasholders destroyed by direct hits, it was possible in all cases to put out the resultant fires without serious damage to the holders.

From the experience collected in this report, it was concluded that there was no difference between either wet or waterless holders in their susceptibility to attack from high-explosive and/or incendiary bombs. Protection from incendiary bombs appeared to be more easily effected in the case of wet than of waterless holders.

Technical Developments during the War

Considerable quantities of brown coal briquettes and wood were used in place of coal. The difficulties which arise from mixing tars from coal and wood are well known, and attempts were, therefore, made to crack them by passing through a vessel filled with hot coke. Brown coal briquettes and wood were also used as producer fuel, the wood being pre-dried wherever possible. Various tar-oil residues were used as enriching agents. In some cases a mixture of fine coal with up to 10% of oil was carbonized and satisfactory results were claimed. Natural gas was used, in Vienna, and mixed with producer gas before distribution. A further source of natural gas, at Bentheim, near the Ruhr, was used in the adjacent "Buna" factory.

The greater production of synthetic petrol gave a much increased output of propane, &c., some of which was used to supplement town gas up to 1943, but thereafter it was restricted to use as motor fuel; for example, in Hanover the quantity used as town gas increased to 43 tons in 1943, but fell to 18 tons in 1944. Most of this gas was liquefied and bottled for motor fuel. Gas-works were ordered to secure maximum production of liquid fuels, and all works with benzole plants had to reduce the benzole in the gas to under 87 gr. per 100 cu.ft.

Attempts were made to maintain production of synthetic oil by the Fischer-Tropsch process by utilizing surplus water gas plant capacity at gas-works, the catalyst vessels and other equipment being recovered from damaged Fischer-Tropsch plants. The large Fischer-Tropsch plants in the Ruhr were all based on the use of water gas; there were adequate coke supplies and some 3 mill. tons were in stock in 1945 in the Ruhr.

A semi-low-temperature coke for producer vehicles was made at a number of works, in vertical-chamber ovens. A considerable quantity of charcoal was also made in gas-works, for the same purpose.

Gas both at low and high pressure was used for motor transport and gas-filling stations were erected in all large towns. A considerable proportion of present German transport still operates on compressed gas, there having been some 53 mill. cu.ft. consumed in January for this purpose in the British zone alone.

Several plants were erected in the Ruhr for catalytic methanization of coke oven gas for use as motor fuel. In 1942, the consumption of methane for this purpose was about 1,500 tons, which increased to nearly 3,000 tons in 1943.

Shortage of gas supply encouraged the development of complete gasification. Gasification of brown coal in the Lurgi generator, using oxygen, was used successfully for supplying town gas in the Leipzig area, and these plants are still in operation. In the Ruhr attempts were made to gasify hard coal, but this does not appear to have progressed beyond the large-scale experimental stage.

Experimental plants were built by Demag and Koppers for the gasification of powdered coal, and an experimental Thyssen-Galocsi plant with an output of 3.5 mill. cu.ft. a day was erected at Hamborn.

Sulphur Removal

Developments in oxide purification were the use of oxygen for revivification (in the Saar area), and the removal of H_2S at high pressures. It is claimed that up to 70% of sulphur was obtained in the spent oxide. Sulphur removal from spent oxides was carried out in two plants erected by the Ruhrgas A.-G., the sulphur being extracted by carbon disulphide and the crude product subsequently purified. In 1942, 20,000 tons of sulphur were recovered. Although various methods of liquid purification were tried out at coke oven plants, none of these was adopted by gas-works. At coke oven plants there are several Thylox plants and one plant using potash solution as absorbent. The use of ammonia for H_2S removal was investigated and several experimental units were built. None of these has, however, been developed into a satisfactory economic process. No serious attempts appear to have been made to increase the recovery of ammonia from gas-works, the large output of synthetic ammonia being adequate to meet requirements.

In generai, there appears to have been little technical development of note in the German Gas Industry during the war; technical improvements and new processes were largely confined to the coke oven industry.

The gas grid companies have developed a meter with a special mechanism for registering loads above a certain value. At Hamburg an all-plastic, domestic meter was developed which incorporated various novel features. This meter has now been in use for several years, and is giving very satisfactory service, particularly with regard to freedom from corrosion.

Up to 1943, the German Gas Industry was characterized by a progressive increase in output, but subsequent difficulties in the supply of coal and labour and the damage due to air raids increased rapidly to culminate in complete breakdown of supply. This has now been restored in nearly all towns in the British zone.

Details of conditions of the Gas Industry in the later stages of the war in the eastern areas outside the British zone are not obtainable, and many statistical records have been destroyed. It is, therefore, difficult to secure a comprehensive account of the conditions during the later part of the war. The German Association of Gas and Water Engineers, purged of its recent undesirable regulations and personnel, has been re-established in the British zone, and has supplied some of the information included in this Paper.

The F.B.I. is to organize a two-day Conference on exports to be held in the Central Hall, London, on Nov. 27 and 28, when practical problems that face industry in the drive for exports will be defined and discussed. At the first session, the Rt. Hon. Sir Stafford Cripps, President of the Board of Trade, will speak on the significance of exports to the national life, and, in succeeding sessions, speakers with wide experience of export problems will give papers on such themes as the respective functions of the Government and of industry in promoting exports, production for export and its relation to production for the home market, and on export selling methods. The Conference will be opened by Sir Clive Baillieu, K.B.E., C.M.G., President of the Federation, and the Chairman of the Conference will be Mr. Leslie Gamage, M.C., Vice-Chairman and Joint Managing Director of the General Electric Company, Ltd.

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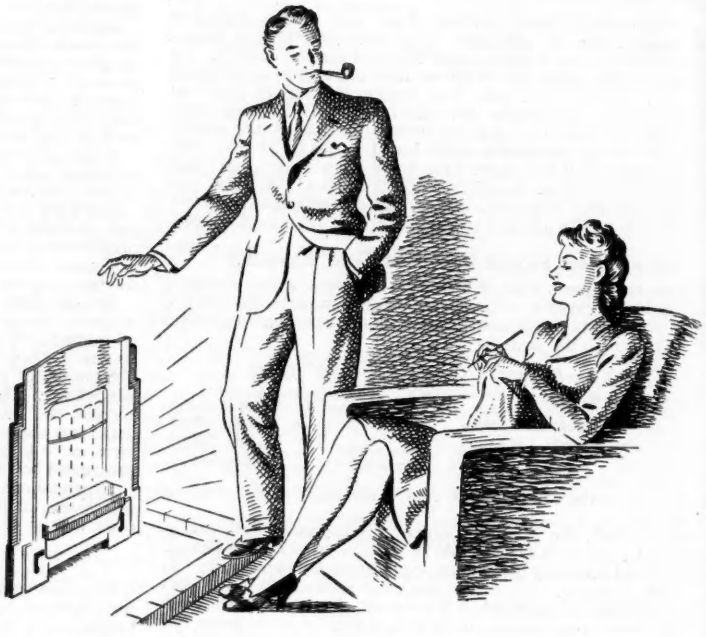

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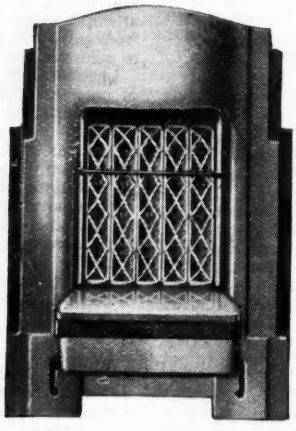

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Combustion Appliance Makers' Association

The Seventh Annual Luncheon of the Combustion Appliance Makers' Association (Solid Fuel) was held at the Connaught Rooms, on July 10, and was attended by some 250 members and guests, including Mr. Emanuel Shinwell, M.P., the Minister of Fuel and Power, and all the members-designate of the National Coal Board.

The Chair was taken by Mr. J. Arthur Reavell, Vice-President, in the absence through indisposition of the President, Mr. S. McEwen.

Proposing the toast of "The Association," Mr. SHINWELL referred to the service which it had rendered to the Ministry during the war years, and said he looked for similar service during the difficult transition period. Provided that the organization in the industry was sound, that vision was shown by the technicians, that the men in the industry pulled their weight, realizing that they were now partners co-operating in a great national industry, he anticipated we should emerge unscathed from the next winter period. But whether scarcity continued or not, the fertility of mind, ingenuity and technical ability of the makers of appliances would always be necessary so that those of the most efficient character could be provided. While he had the most honourable intentions towards the electricity and gas industries and intended to expand them and put them on their legs, he was equally as interested in the scientific and efficient use of solid fuel as when he became Secretary for Mines in 1924. He did not, however, propose to nationalize an appliance industry.

He had recently seen material hitherto regarded as waste being converted into a valuable fuel, and on a visit to opencast workings had seen that British engineering could produce even better machinery than the American upon which they had been relying.

No one who burned coal was any friend of his, and he hoped that research would lead to our coal being converted into another form of fuel with valuable by-products which could form the basis of new industries.

In responding to the toast, the Chairman, Mr. J. ARTHUR REAVELL, pointed out that the appliance makers occupied a place between the coal producers—which after to-day will be the Government itself—and the consumers, and it was their task to design and produce appliances to burn this fuel as efficiently as possible. With their technical experience and practical understanding of the whole problem, they believed they would be able to be of help both to the Ministry and to the National Coal Board. However, it would be of little use to design appliances for a specific type of coal only to find that the type became unavailable. Coal was produced in many types and grades, and we must produce the apparatus to deal with them.

Proposing the toast of "Our Guests," Mr. H. CHRISTOPHER (Vice-President) attributed the distinguished gathering to a realization of the vital contribution the appliance makers could make and are making in conserving our great national asset—coal. Further, that their presence was an acceptance of the fact that nothing less than complete co-operation between the State, the distributors, and the appliance makers would be effective. He asked that the National Coal Board should give them their fullest confidence, tell them what to expect as regards grading and quality and try to give some stability in quality and uniformity in deliveries. Given these, he promised the best possible equipment for the job. He wished Lord Hyndley and his colleagues success in their labours and promised them full support.

LORD HYNDLEY, G.B.E. (Chairman-designate of the National Coal Board), in responding, said that one reason why every member of the new Board was present was because they looked upon the occasion as a kind of birthday party and hoped that in a couple of years time they would enjoy the same confidence as was resposed in them to-day. On the subject of research, the Board were fully alive to its importance, and would encourage it to the fullest degree. He went on: "With regard to the British Coal Utilization Research Association, I think you would like to know that it is our intention to continue that Association in some shape or form, and we shall seek an arrangement which I trust will be satisfactory both to the Association and to the Board." The help of the Association—indeed, of all kindred associations and not least that of the Women's Advisory Committee on Solid Fuel, to which Mr. Christopher had referred—would be wanted, and on behalf of its guests he thanked them most sincerely for their generous hospitality.

The Minister of Fuel and Power has decided that the Kerosene (Paraffin Oil) Priority Scheme, which was introduced on Aug. 1, 1943, will be continued for a further 12 months commencing Aug. 1, 1946. The scheme will continue to operate as hitherto, and it will not be necessary for registered consumers to make fresh applications for priority. Holders of current Kerosene Record Cards will be sent, through the post, new Record Cards for 1946/47. These are expected to be in the hands of registered consumers by the end of July and when received must be taken to the retailer named thereon to be endorsed. Any consumer who does not receive his new card by Aug. 1 can obtain his necessary supplies against his 1945/46 card until such time as the new card is received.

Denny Developments

Whether in view of imminent nationalization it was advisable to proceed with the installation of an additional three-lift gasholder at the gas-works with a capacity of 500,000 cu.ft. and at a cost of approximately £25,000 was a problem before the Denny and Dunipace Town Council. The question was raised when a lay-out plan of the proposed extension, with three estimates for carrying out the work, were submitted by Mr. R. M. Simpson, Engineer and Manager. In view of the time that would be required to get delivery—approximately two years—and the getting of the order placed now, he urged that the matter should be settled immediately. Further, he pointed out that the question came under the jurisdiction of the Ministry of Fuel and Power.

Raising the prospect of nationalization, Bailie Timmons said that at the present time it would be better to cut the price of gas and give the gas consumers of Denny something, for, from what he had read about nationalization, gas undertakings owned by private companies were going to be compensated, but in the case of an undertaking owned by a local authority the Government would simply come along and take it. The interest on the borrowed money was bound to come out of the pockets of the consumers.

There was some further discussion during which the matter of urgency was stressed. The opening of the three sealed tenders was vetoed, but later, on the Town Clerk pointing out that by opening these and forwarding them to the Ministry of Fuel and Power for their observations, the Town Council were not committing themselves, the tenders were opened and noted. It was finally agreed that the matter should be remitted to the Gas Committee with powers, and the same decision applied to servicing with gas of the various County Council housing schemes, costs for which were submitted.

Stourbridge Gas Department.—Receipts on revenue account from all sources for the year ended Mar. 31 at £198,915 showed an increase of £16,648 over the previous year, and expenditure at £168,515 was £15,402 more than in 1944-45. The revenue profit was £30,399, compared with £29,153. After providing a contribution to the General District Fund of £2,700, a balance of £341 was transferred to the equalization fund. Gas sales totalled 611,207,795 cu.ft., an increase of 4% over the previous year, mainly accounted for by public lighting and domestic uses.

Kirkcaldy Gas Department.—The year's accounts closed with a profit of £4,142. Income from sales of gas totalled £76,129, representing nearly 392 million cu.ft., a record for the undertaking and a substantial increase over last year; £32,309 was realized from sales of coke, tar and benzole, including £13,370 as the value of coke used in the works. Income from sales of residuals did not, in general, compare satisfactorily with the year's estimate, the reverse being true in the case of sales of gas. Coal costs totalled £45,364, average price per ton having increased during the year from 39s. 10d. to 44s. 4d., which figure is almost exactly double the average price paid in 1940. Total fuel costs were £59,973 as against £53,086 last year; these figures are arrived at after crediting the subsidies on fuel oil which have so far continued at a satisfactory level. On the revenue side £5,936 was brought in from the stoves and fittings account. This included an estimated sum of £4,000 as profit on current hire purchase contracts in terms of accounting arrangements already approved by the Council, and this is the main contributor to the figure of net profit.

Lincoln Gas Department.—During the year ended Mar. 31, Lincoln Corporation's trading undertakings showed a total net profit of £36,697, of which £35,000 is to be transferred to the relief of rates. The trading committees are to be consulted as to proportion of this sum each undertaking shall allocate. Profits of the gas undertaking were £13,258. A Gas Committee recommendation that a rebate of 10% be granted to all consumers in respect of the amount paid by them for gas this year was approved. It is estimated that the cost of the rebate will be about £17,000. At £195,751 the cost of manufacture of gas was £14,210 more than in the preceding year, while distribution cost £1,060 more and repayment of loans and interest was £21,164, against £18,070 in 1944-45. During the year 72,725 tons of coal were carbonized, compared with 76,589 in the previous 12 months, and the amount of gas made was correspondingly less—1,177,921,000 cu.ft. in 1945-46 and 1,238,732,000 cu.ft. in 1944-45. Coke and breeze made for sale reached a total of 40,843 tons, representing an increase. New mines laid measured almost three times more than in 1944-45. The capital assets of the undertaking are £711,083, of which works and plant account for £427,161, mains and services £211,068 and meters £55,367. Councillor Martin remarked that within 50 miles of Lincoln gas was being sold at more than 5s. per 1,000 cu.ft. (Lincoln's charge was 3s. 1d.).

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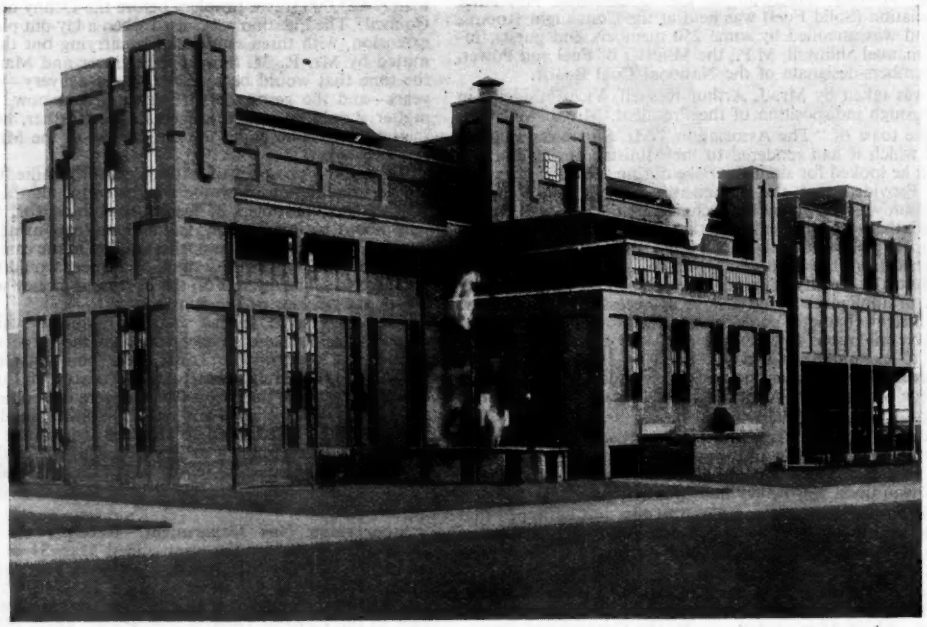

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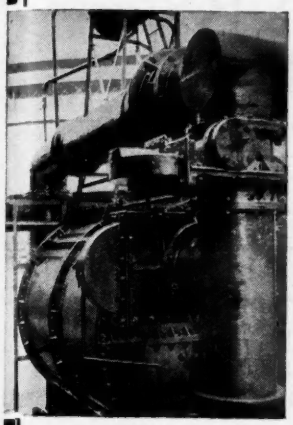

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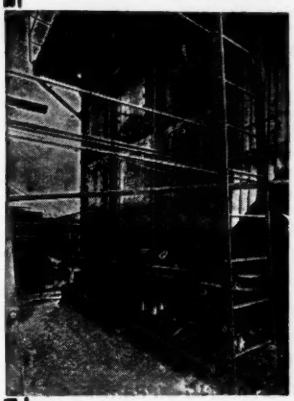

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Gas Products Prices

The London Market

July 22.

The prices of Coal Tar Products are unchanged. The following are controlled by Government Orders :—

Crude anthracene, 10d. per unit delivered to dyestuffs manufacturers and 9d. per unit in other cases, for material of which delivery is taken elsewhere than at sellers' premises. Unrefined crude anthracene, 15%-16%, £9 2s. per ton ; 35%-40%, £26 14s. per ton, free on rail at sellers' works.

The Provinces

July 22.

Average prices of gas-works products: Pitch, 70s. per ton; toluole, naked, North, 90's, 2s. 4d. to 2s. 6¾d. per gallon; pure, 3s. 2¼d. Prices for carbolic acid 60's, anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.), and strained anthracene oil are controlled by Government Orders. Prices for road tar were increased by a half-penny per gallon by S. R. & O. 1945, 229, under which Order there was also an increase of 5s. per ton in the price for standard creosote-pitch mixture.

Scotland

July 20.

Owing to local holidays deliveries have been held up. *Refined Tar.** Yield to the Distiller is 5d. per gall. ex works, naked. *Creosote Oil.* Timber preserving quality*, 5½d. to 6½d. per gall.; Hydrogenation Oil,* 5⅞d. per gall.; Low Gravity or Virgin Oil†, 7¼d. to 7½d. per gall.; Benzol Absorbing Oil,* 6½d. to 8d. per gall. *Refined Cresylic Acid** is 3s. 6d. to 4s. 6d. per gall. ex works, naked, according to quality. *Crude Naphtha*†, 7d. to 8d. per gall. *Solvent Naphtha.** Basic maximum prices delivered in bulk, 90/160 grade, 2s. 10d. per gall., and 90/190 Heavy Naphtha, Unrectified, 2s. 0½d. per gall.; Rectified, 2s. 4d. per gall. *Pyridine*,† 90/160 grade, 13s. per gall., and 90/140 grade, 15s. per gall.

* Price controlled. †Uncontrolled.

Stocks and Shares

Despite the removal of an uncertainty, markets were not responsive to the approval of the American loan and during the earlier part of last week were dull and without interest. On Thursday business was a little brighter with British Funds hardening and there were some good features among industrials, but the better tone was not maintained and by the end of the week markets became dull again.

A little more business than of late was recorded among Gas stocks and shares, and prices generally closed firm with only a few reactions. The stocks of the two Indian companies again hardened, Bombay shares rising 1s. and Oriental a further 3 points. Another good feature was the rise of 1s. in United Kingdom Ordinary while a few debenture issues also improved. On the local Exchange, Newcastle units closed 4½d. higher. The following is the full list of price changes on the week to Thursday last:

OFFICIAL LIST.

Bombay		46/ —48/	+ 1/
Cardiff ord	xd	119— 24	July 15
Gas Light 4 p.c. pref.		102—105	+ ½
Imperial Continental...		107—112	- 1
Liverpool ord....		113—116	- 1
Mid Southern Utility "C" ...		103—108	+ 2
Oriental		235—245	+ 3
Primitiva ord....		11/3 —12/3	- -/9d.
Severn Valley Gas Corpn. ord.	xd	20/ —22/	July 15
South Metropolitan 5 p.c. red.deb.	xd	100—10[illegible]	July 15
South Suburban 5 p.c. deb. ...		120—125	+ 2
United Kingdom Gas Corpn. ord.		21/6 —22/6	+ 1/
Wandsworth 5 p.c. deb.		120—125	+ 2

PROVINCIAL EXCHANGES.

Newcastle units		23/ —23/6	+ /4½d.
Do. 4 p.c. pref. ...	xd	101½—103½	- ½
Sheffield Cons....		133—137	+ 1

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